



US008553169B2

(12) **United States Patent**  
**Lee et al.**

(10) **Patent No.:** **US 8,553,169 B2**  
(45) **Date of Patent:** **Oct. 8, 2013**

(54) **DISPLAY DEVICE AND METHOD OF ASSEMBLING THE SAME**

(56) **References Cited**

(75) Inventors: **Ah-Ram Lee**, Jeonju-si (KR); **Jae-Lok Cha**, Goyang-si (KR); **Wal-Hee Kim**, Yongin-si (KR)

U.S. PATENT DOCUMENTS

2002/0171784	A1*	11/2002	Choi et al.	349/58
2006/0103775	A1*	5/2006	Chung	349/58
2007/0132905	A1*	6/2007	Kim et al.	349/58
2008/0094536	A1*	4/2008	Kim	349/58

(73) Assignee: **Samsung Display Co., Ltd.** (KR)

FOREIGN PATENT DOCUMENTS

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 279 days.

JP	2003121816	4/2003
KR	1020060078676	7/2006
KR	1020070076902	7/2007
KR	1020070078009	7/2007

(21) Appl. No.: **12/204,031**

\* cited by examiner

(22) Filed: **Sep. 4, 2008**

*Primary Examiner* — Mark Robinson

*Assistant Examiner* — Jerry Blevins

(65) **Prior Publication Data**  
US 2009/0153766 A1 Jun. 18, 2009

(74) *Attorney, Agent, or Firm* — Cantor Colburn LLP

(30) **Foreign Application Priority Data**  
Dec. 13, 2007 (KR) ..... 10-2007-0130074

(57) **ABSTRACT**  
A display device includes a display panel having an upper surface and being configured to display an image, a mold frame configured to receive the display panel, and a lower receiving member having an inner wall disposed on a peripheral area thereof and being configured to receive mold frame and the display panel. The mold frame includes a peripheral area disposed around an open portion of the mold frame, and a side wall disposed in the peripheral area. The side wall of the mold frame is connected to the inner wall of the lower receiving member, and the panel supporter of the mold frame is disposed on the upper surface of the display panel to support the display panel.

(51) **Int. Cl.**  
**G02F 1/1333** (2006.01)  
**H01J 9/24** (2006.01)  
(52) **U.S. Cl.**  
USPC ..... **349/58; 445/24**  
(58) **Field of Classification Search**  
USPC ..... 349/58; 445/24  
See application file for complete search history.

**17 Claims, 8 Drawing Sheets**

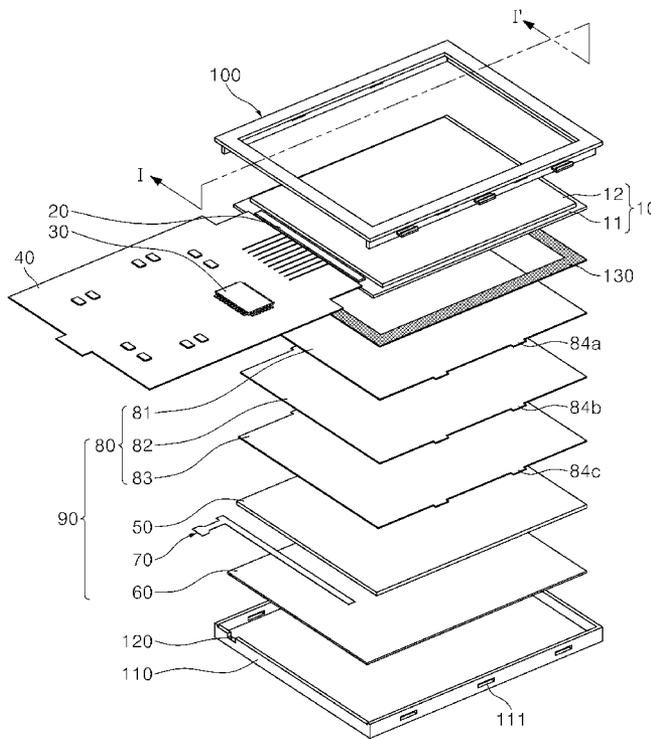


FIG. 1

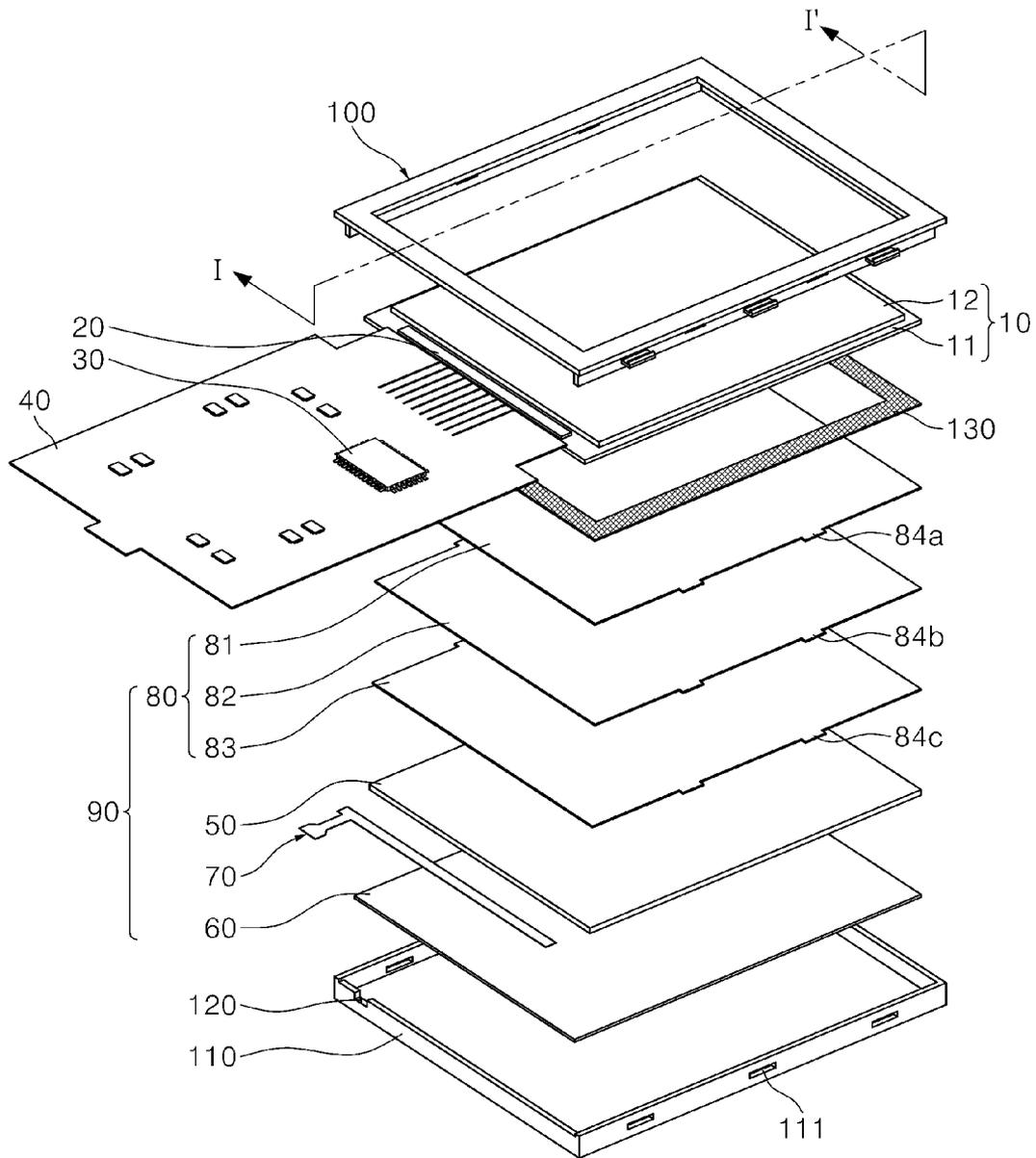


FIG. 2A

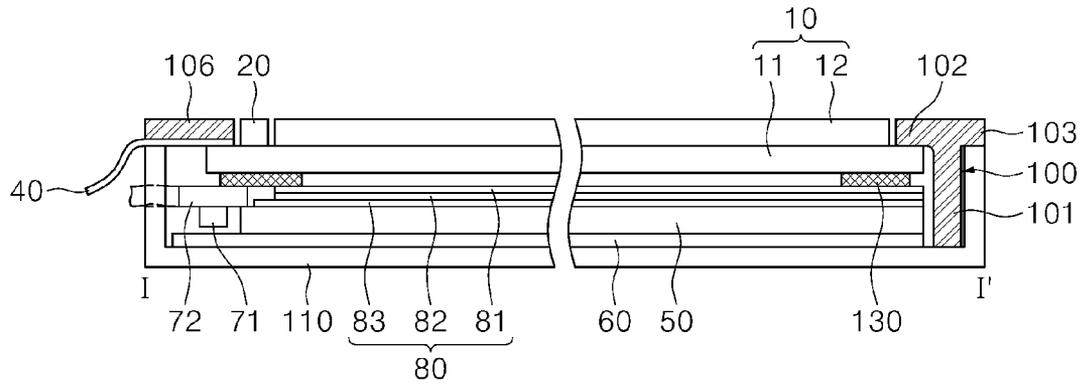


FIG. 2B

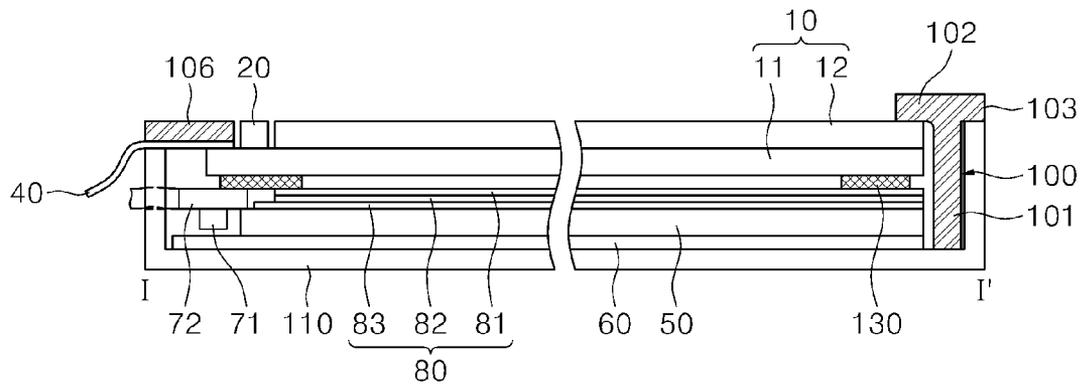


FIG. 3

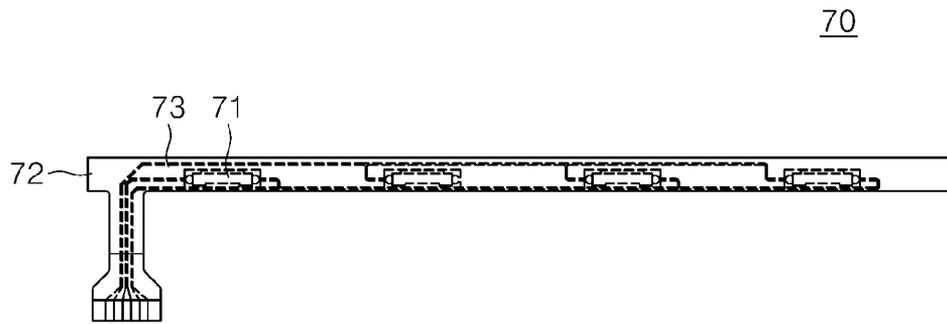


FIG. 4

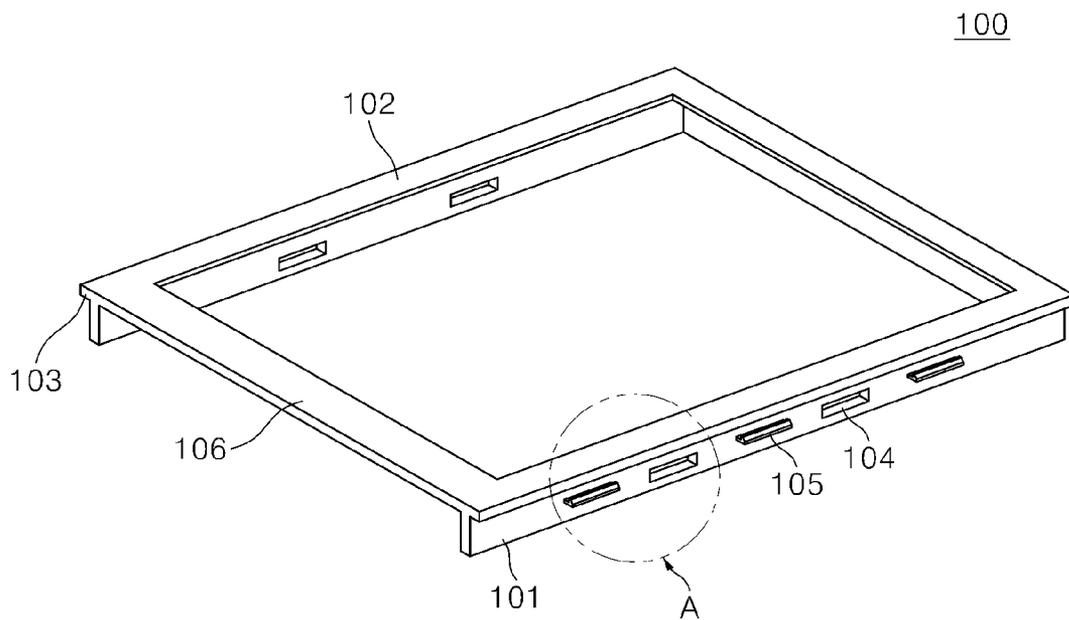


FIG. 5

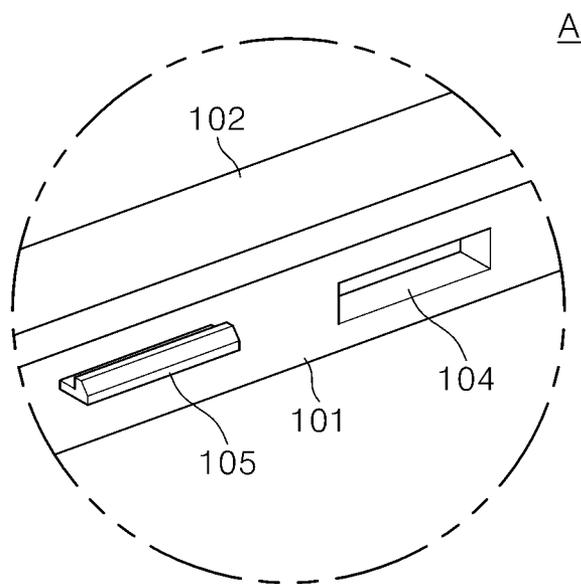


FIG. 6

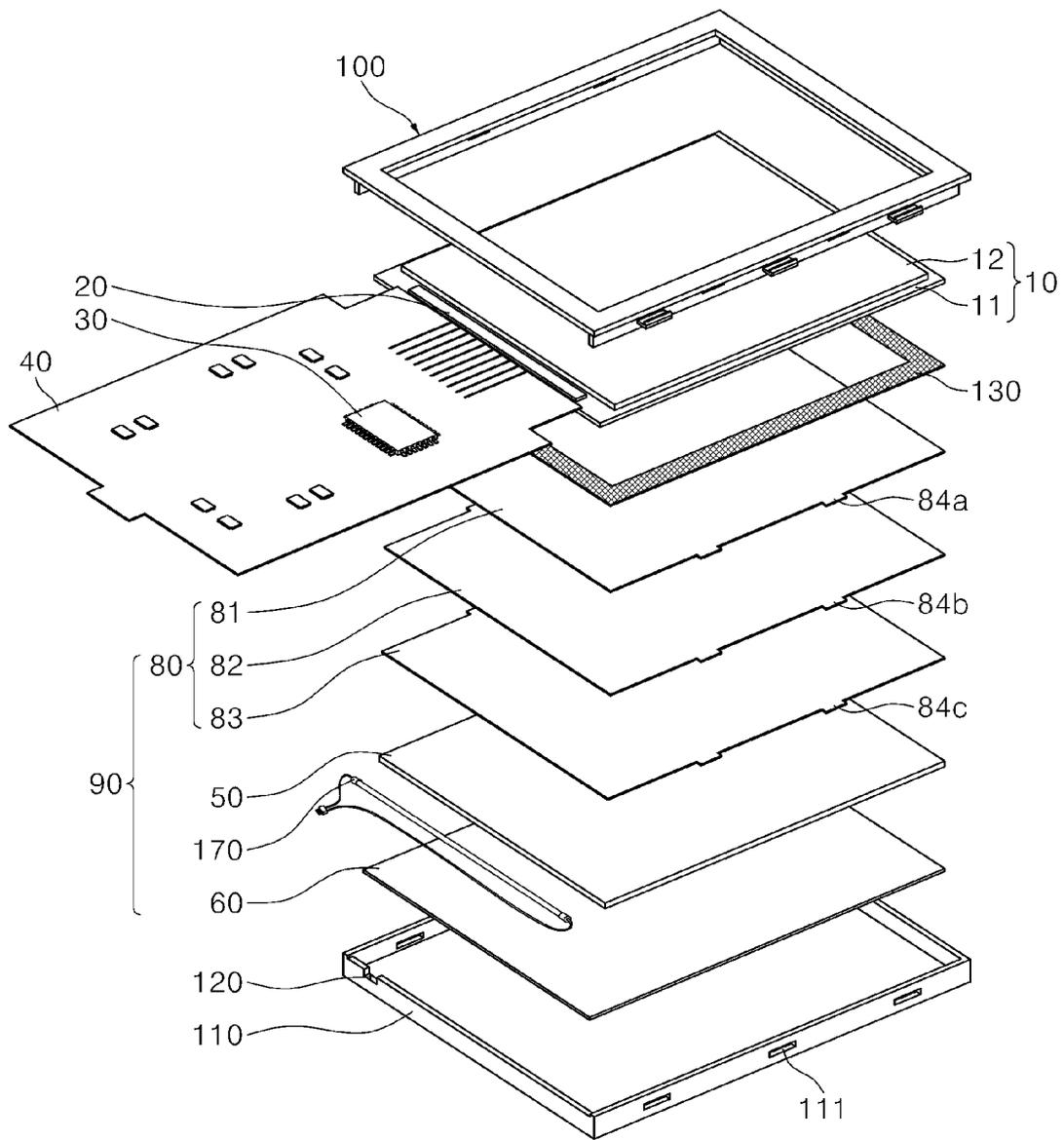


FIG. 7

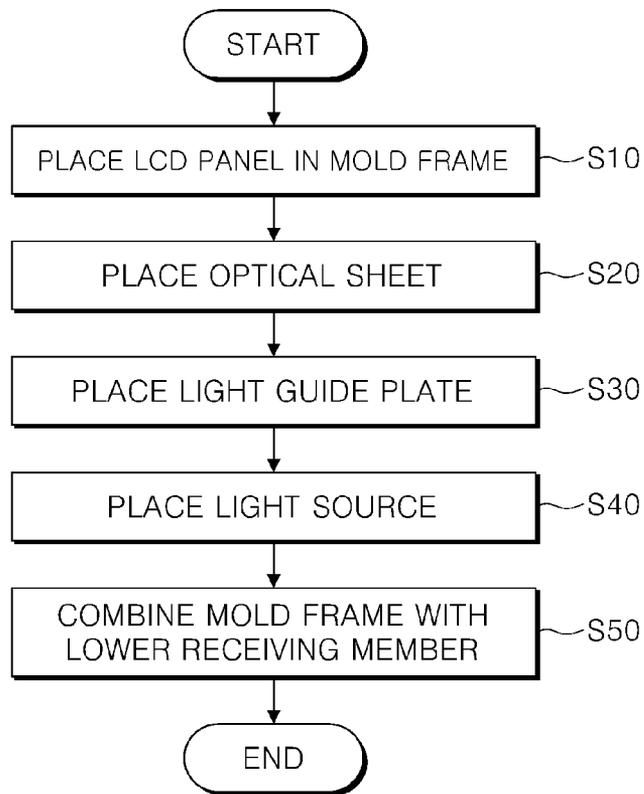


FIG. 8A

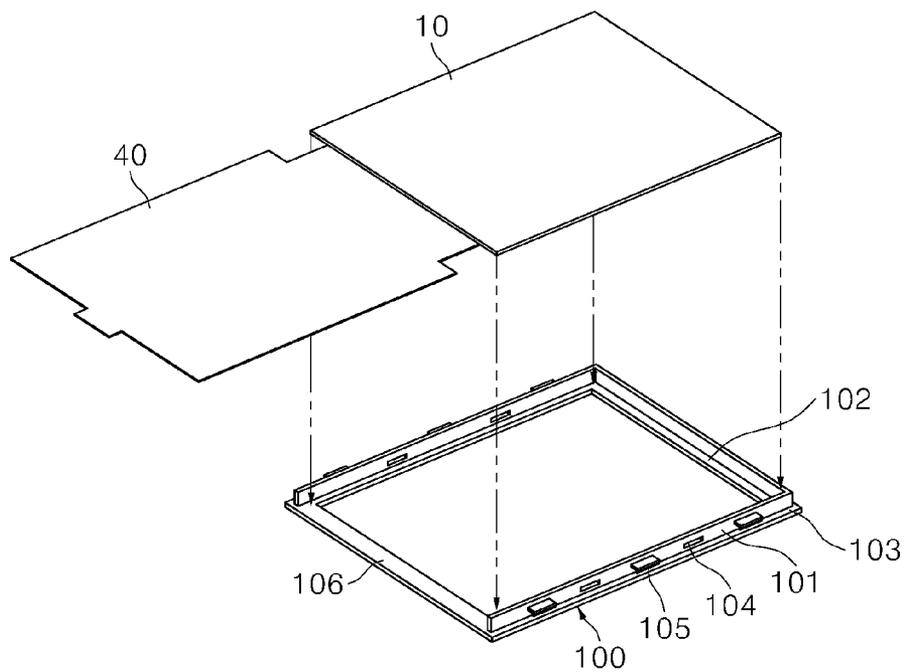


FIG. 8B

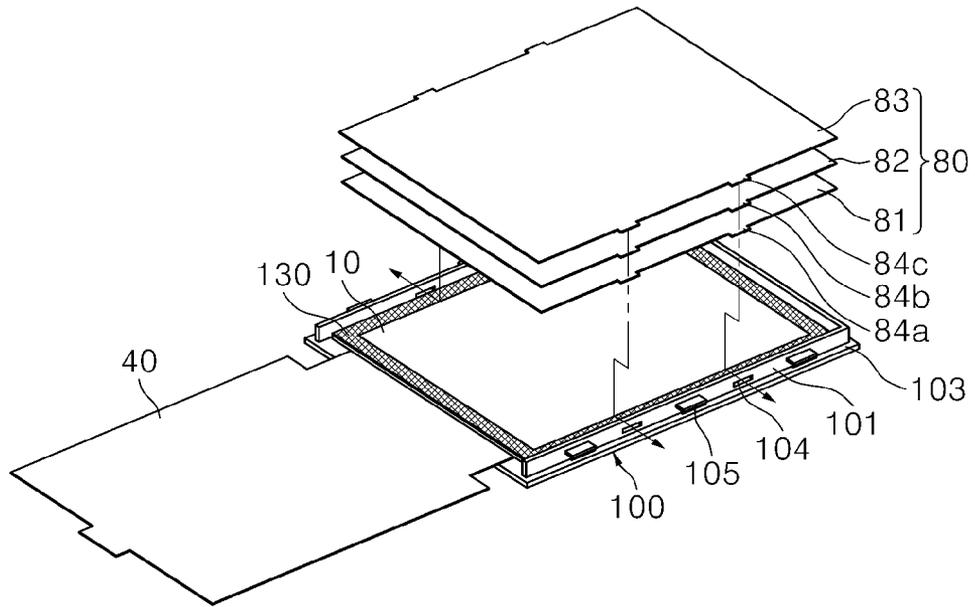


FIG. 8C

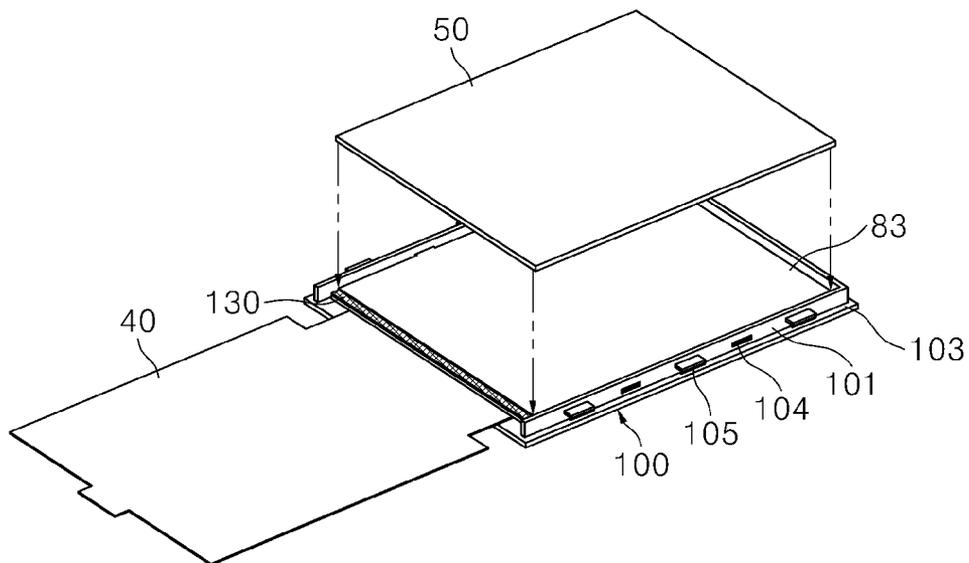


FIG. 8D

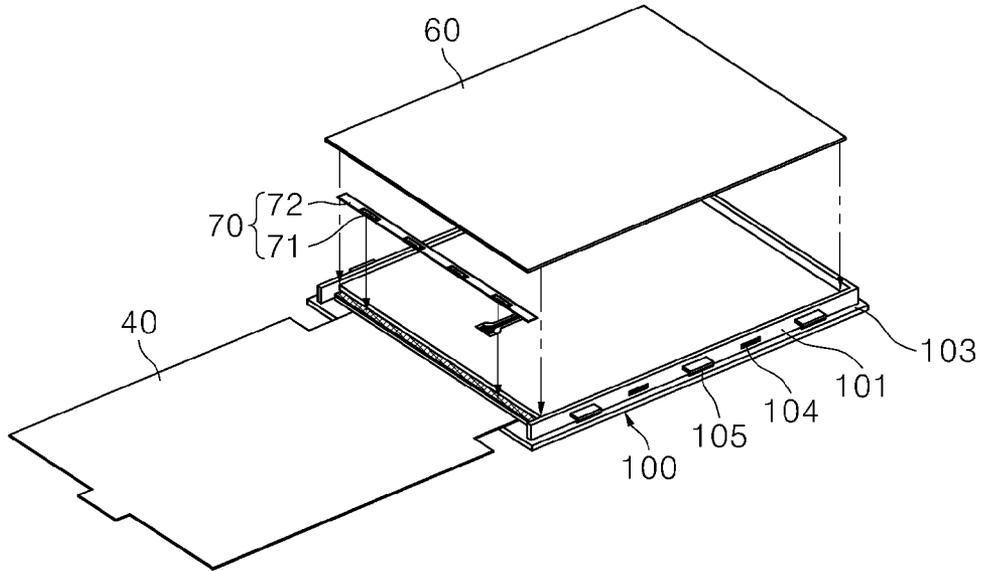
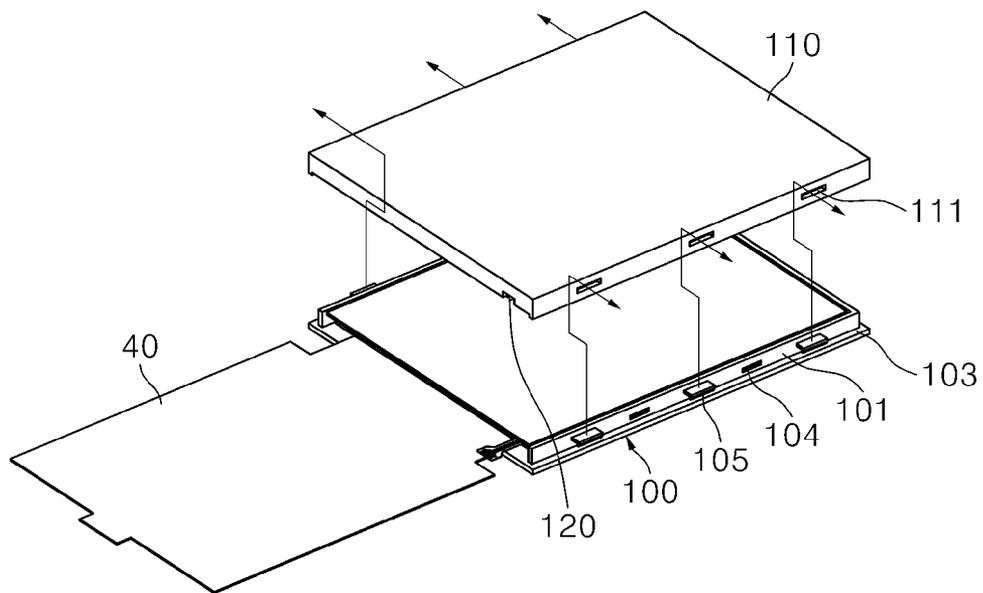


FIG. 8E



## DISPLAY DEVICE AND METHOD OF ASSEMBLING THE SAME

This application claims priority to Korean Patent Application No. 2007-0130074, filed on Dec. 13, 2007, and all the benefits accruing therefrom under 35 U.S.C. §119, the contents of which in its entirety are herein incorporated by reference.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a display device which includes a mold frame, and a method of assembling the display device.

#### 2. Description of the Related Art

The advent of an information society has led to an increasing importance of liquid crystal display ("LCD") devices. Despite having some advantages with respect to price and performance, for example, cathode ray tubes ("CRTs"), which have historically been used in various display devices, are becoming more and more unpopular due to their larger size and reduced portability in comparison with LCD devices. Specifically, the LCD devices are gaining popularity due to advantages such as compact size, light weight and low power consumption, for example, as compared to CRTs. As a result, the LCD devices are considered as an increasingly attractive alternative to the CRTs.

In general, the LCD device includes an LCD panel for displaying images, a driver for driving the LCD panel, a backlight unit for illuminating the LCD panel, and a chassis unit for receiving and fixing the abovementioned components therein.

In a process of assembling the LCD device, the backlight unit is received in a lower receiving member and is covered with a mold frame, and then the LCD panel is mounted to the mold frame. An attaching member is disposed between the mold frame and the LCD panel to fix the LCD panel to the mold frame. A top chassis is then combined with the lower receiving member to fix the LCD panel therebetween.

Recently, LCD devices have been assembled without the top chassis to make the LCD devices thinner and lighter. Not providing the top chassis in the LCD device, however, causes the LCD panel to separate from the mold frame, since the LCD panel is not sufficiently fixed to the mold frame by the attaching member alone.

### BRIEF SUMMARY OF THE INVENTION

An exemplary embodiment of the present invention provides a display device which does not include a top chassis, thereby effectively reducing a thickness thereof, while still preventing a display panel of the display device from coming off of a mold frame, and a method of assembling the display device.

In an exemplary embodiment of the present invention, a display device includes a display panel having an upper surface and configured to display an image, a mold frame configured to receive the display panel, and a lower receiving member having an inner wall disposed on a peripheral area thereof and configured to receive the mold frame and the display panel. The mold frame includes a peripheral area disposed around an open portion of the mold frame, a side wall disposed in the peripheral area, and a display panel supporter extending from the side wall toward the open portion of the mold frame. The side wall of the mold frame is connected to the inner wall of the lower receiving member,

and the panel supporter of the mold frame is disposed on the upper surface of the display panel to support the display panel.

A thickness of the side wall is one of a uniform thickness and a non-uniform thickness. The non-uniform thickness decreases as the side wall extends away from the peripheral area toward the open portion of the mold frame.

The mold frame may further include a protrusion extending from the side wall away from the open portion of the mold frame, the inner wall of the lower receiving member may include a fixing aperture, and the protrusion of the mold frame may be inserted into the fixing aperture of the inner wall of the lower receiving member.

The display device may further include a light source disposed between the mold frame and the lower receiving member, and the mold frame may further include a light leakage prevention portion disposed above the light source on a portion of the peripheral area of the mold frame.

The mold frame may further include an extending portion which extends from the side wall away from the open portion of the mold frame and is disposed on an upper peripheral surface of the lower receiving member.

The display device may further include a backlight unit disposed between the lower receiving unit and the display panel and including a light source configured to generate light and a light guide plate disposed on the light source to direct the light from the light source to the display panel.

The light source includes one of a cold cathode fluorescent lamp and a hot cathode fluorescent lamp.

The backlight unit further includes at least one optical sheet configured to receive the light generated by the light source, and the optical sheet may include at least one of a protective sheet, a prism sheet and a diffusion sheet.

The display device may further include a reflective sheet disposed on the light guide plate to reflect the light to the light guide plate.

The display device may further include an attaching sheet disposed between the display panel and the optical sheet to attach the display panel and the optical sheet.

The light source includes a light source substrate on which a light emitting diode is disposed.

The display device may further include an attaching sheet disposed between the light source substrate and the display panel to attach the light source substrate to the display panel.

The display device may further include a driver configured to drive the display panel and a circuit board disposed above the light source on a peripheral side of the display panel to transmit a driving signal to the driver.

The mold frame may further include a hook extending from the side wall away from the open portion of the mold frame, the inner wall of the lower receiving member may include a connection aperture, and the hook of the mold frame may be inserted into the connection aperture.

An alternative exemplary embodiment of the present invention provides a method of assembling a display device. The method includes disposing a display panel in a mold frame, disposing a light guide plate on the display panel, disposing a light source proximate to a side of the light guide plate, and combining the mold frame with the lower receiving member. The mold frame includes a peripheral area disposed around an open portion of the mold frame, a side wall disposed in the peripheral area, a display panel supporter extending from the side wall toward the open portion of the mold frame, and an extending portion which extends outwardly from the side wall away from the open portion of the mold frame to be disposed on an upper peripheral surface of a lower receiving member configured to receive the mold frame.

The method may further include, after said disposing the display panel in the mold frame, disposing an optical sheet between the display panel and the light guide plate. The optical sheet includes at least one of a protective sheet, a prism sheet and a diffusion sheet.

The method may further include, before said placing the optical sheet, disposing an attaching member on a periphery of the display panel facing the lower receiving panel, and attaching the attaching member to the optical sheet.

Said disposing the optical sheet includes inserting a protrusion disposed on the optical sheet into a corresponding fixing aperture disposed in the side wall of the mold frame.

The method may further include, after said disposing the display panel in the mold frame, disposing an attaching member on a periphery of the display panel facing the lower receiving panel, attaching the attaching member to the light guide plate, and attaching the attaching member to the light source.

Said combining the mold frame with the lower receiving member includes inserting a hook which protrudes from the side wall of the mold frame into a connection aperture disposed in the lower receiving member.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of the present invention will become more readily apparent by describing in further detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of a liquid crystal display ("LCD") device according to an exemplary embodiment of the present invention;

FIGS. 2A and 2B are cross-sectional views taken along line I-I' of FIG. 1;

FIG. 3 is a plan view illustrating a light source of the LCD device according to the exemplary embodiment of the present invention shown in FIG. 1;

FIG. 4 is a perspective view illustrating a mold frame of the LCD device according to the exemplary embodiment of the present invention shown in FIG. 1;

FIG. 5 is an enlarged perspective view of area "A" of FIG. 4;

FIG. 6 is an exploded perspective view of an LCD device according to an alternative exemplary embodiment of the present invention;

FIG. 7 is a flow chart illustrating steps of a method of assembling an LCD device according to an exemplary embodiment of the present invention; and

FIGS. 8A to 8E are exploded perspective views illustrating sequential steps of assembling an LCD device using the method according to the exemplary embodiment of the present invention shown in FIG. 7.

#### DETAILED DESCRIPTION OF THE INVENTION

The invention will now be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. The present invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numerals refer to like elements throughout.

It will be understood that when an element is referred to as being "on" another element, it can be directly on the other element or intervening elements may be present therebetween.

In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

It will be understood that although the terms "first," "second," "third" etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," or "includes" and/or "including," when used in this specification, specify the presence of stated features, regions, integers, steps, operations, elements and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components and/or groups thereof.

Furthermore, relative terms, such as "lower" or "bottom" and "upper" or "top" may be used herein to describe one element's relationship to other elements as illustrated in the Figures. It will be understood that relative terms are intended to encompass different orientations of the device in addition to the orientation depicted in the Figures. For example, if the device in one of the figures is turned over, elements described as being on the "lower" side of other elements would then be oriented on the "upper" side of the other elements. The exemplary term "lower" can, therefore, encompass both an orientation of "lower" and "upper," depending upon the particular orientation of the figure. Similarly, if the device in one of the figures were turned over, elements described as "below" or "beneath" other elements would then be oriented "above" the other elements. The exemplary terms "below" or "beneath" can, therefore, encompass both an orientation of above and below.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the present invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning which is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

Exemplary embodiments of the present invention are described herein with reference to cross section illustrations which are schematic illustrations of idealized embodiments of the present invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the present invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes which result, for example, from manufacturing. For example, a region illustrated or described as flat may, typically, have rough and/or nonlinear features. Moreover, sharp angles which are illus-

trated may be rounded. Thus, the regions illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the precise shape of a region and are not intended to limit the scope of the present invention.

Hereinafter, exemplary embodiments of the present invention will be described in further detail with reference to the accompanying drawings.

FIG. 1 is an exploded perspective view of a liquid crystal display ("LCD") device according to an exemplary embodiment of the present invention, FIGS. 2A and 2B are cross-sectional views taken along line I-I' of FIG. 1, and FIG. 3 is a plan view showing a light source of the LCD device according to the exemplary embodiment of the present invention shown in FIG. 1.

Referring to FIGS. 1 to 3, the LCD device includes an LCD panel 10, a driver 20, a backlight unit 90, a lower receiving member 110 and a mold frame 100.

The LCD panel 10 includes a thin film transistor ("TFT") substrate 11, a color filter substrate 12 and a liquid crystal layer (not shown) disposed between the TFT substrate 11 and the color filter substrate 12. A TFT array (not shown) is arranged on the TFT substrate 11, and a color filter array (not shown) is arranged on the color filter substrate 12.

The LCD panel 10 includes a liquid crystal cell (not shown) which is driven by a TFT (not shown). The TFT is arranged in a pixel area, and a gate line (not shown) and a data line (not shown) intersect each other near the pixel area. The LCD panel 10 supplies a pixel voltage from the data line to the liquid crystal cell, an liquid crystal molecules (not shown) are thereby driven, e.g., aligned, based on the pixel voltage in response to a scan signal, e.g., a gate driving signal, supplied from the gate line.

In an exemplary embodiment, the LCD panel 10 is supported by a panel supporter 102 of the mold frame 100. For example, an upper surface of the TFT substrate 11 may be supported by the panel supporter 102 of the mold frame 100 as shown in FIG. 2A. In an alternative exemplary embodiment, an upper surface of the color filter substrate 12 may be supported by the panel supporter 102 of the mold frame 100, as shown in FIG. 2B.

The driver 20 may include a gate driver (not shown) and a data driver (not shown). In an exemplary embodiment, the driver 20 is mounted on the LCD panel 10, as shown in FIGS. 1, 2A, and 2B. Alternatively, the driver 20 may be mounted on a circuit board 40 (FIG. 1) of the LCD device having the LCD panel 10.

The gate driver (not shown) sequentially supplies the gate driving signal to the gate line disposed on the LCD panel 10. The gate driving signal may include a gate on voltage and a gate off voltage, for example.

The data driver (not shown) supplies the pixel voltage to data line disposed on the LCD panel 10.

In operation, the driver 20 receives a pixel data signal and an initial driving voltage from the circuit board 40, which is electrically connected to an external component (not shown).

In an exemplary embodiment, the circuit board 40 is formed of a flexible material. Further, an electronic element 30 may be disposed on the circuit board 40.

In an exemplary embodiment, the electronic element 30 includes a timing controller (not shown) and a power supply (not shown). The timing controller supplies timing signals to both the gate driver and the data driver, and further supplies the pixel data signal to the data driver. The power supply supplies driving voltages to the gate driver, the data driver, and the LCD panel 10. The driving voltage includes, for example, the gate on voltage, the gate off voltage, an analogue

driving voltage and a common voltage, but alternative exemplary embodiments are not limited thereto.

The backlight unit 90 supplies light to the LCD panel 10. In an exemplary embodiment, the backlight unit 90 includes one of an edge-type backlight unit and direct-type backlight unit. The edge-type backlight unit emits light toward a peripheral edge of the LCD panel. The direct-type backlight unit emits light toward a lower surface of the LCD panel as viewed in FIGS. 1, 2A and 2B. For purposes of explanation herein, the backlight unit 90 will be described as an edge-type backlight unit, but alternative exemplary embodiments of the present invention are not limited thereto.

The backlight unit 90 includes a light source 70, a light guide plate 50, a reflective sheet 60 and an optical sheet 80.

The light source 70 includes a light source substrate 72 and a light emitting diode ("LED") 71, as shown in FIGS. 2A, 2B and 3.

The LED 71 is disposed proximate to a peripheral side of the light guide plate 50, as shown in FIG. 3, to supply light to the light guide plate 50.

In an exemplary embodiment, a plurality of LEDs 71 may be disposed on the light source substrate 72. In addition, a plurality of signal lines 73 may be disposed on the light source substrate 72 to supply driving signals from an external component (not shown) to LEDs 71 of the plurality of LEDs 71. The light source plate 72 may include a heat sink (not shown) which radiates heat generated from the LEDs 71 away from the light source plate 72 and/or the LEDs 71. The circuit board 72 is formed of a flexible material, for example, but alternative exemplary embodiments are not limited thereto.

The LEDs 71 of the light source 70 are disposed at a predetermined distance from the light guide plate 50. As a result, problems such as a bright line, for example, caused by an improper distance between the light guide plate 50 and LED 71, are substantially reduced and/or effectively prevented.

The light source 70 may overlap a portion of the circuit board 40 such that the circuit board 40 prevents light generated in the light source 70 from leaking out of the LCD panel 10.

The light guide plate 50 directs light from the LED 71 to the LCD panel 10. The light guide plate 50 is disposed under the LCD panel 10 as shown in FIGS. 1, 2A and 2B. In an alternative exemplary embodiment, the light guide plate 50 may include prism lines (not shown) on an upper side and/or a lower side thereof. The prism lines increase a light collection efficiency and therefore reduce a number of optical sheets 80 required in the LCD device.

The reflective sheet 60 reflects the light supplied from the light source 70 to the light guide plate 50 to improve a light-use efficiency of the light source 70.

The optical sheet 80 includes a protection sheet 81, a prism sheet 82 disposed on the protection sheet 81, and a diffusion sheet 83 disposed on the prism sheet 82, but alternative exemplary embodiments are not limited thereto.

The diffusion sheet 83 diffuses light supplied from the light guide plate 50 to reduce and/or effectively prevent bright lines and/or dark lines in the LCD device according to an exemplary embodiment of the present invention.

The prism sheet 82 increases a directivity of the light diffused by the diffusion sheet 83, effectively increasing a brightness of the light to be supplied to the LCD panel 10. In an alternative exemplary embodiment, a plurality of prism sheets 82 is provided.

The protective sheet 81 protects the prism sheet 82 from damages such as scratches, for example. The protective sheet

**81** also prevents formation of static electricity between the LCD panel **10** and the prism sheet **82**.

In an exemplary embodiment, the optical sheet **80** includes at least one protrusion. Specifically, the protective sheet **81**, the prism sheet **82** and the diffusion sheet **83**, include at least one protrusion **84a**, **84b** and **84c**, respectively, as shown in FIG. 1. More specifically, the protective sheet **81** includes a first protrusion **84a**, the prism sheet **82** includes a second protrusion **84b** and the diffusion sheet **83** includes a third protrusion **84c**. The first protrusion **84a**, the second protrusion **84b** and the third protrusion **84c** may be disposed to overlap each other, as shown in FIG. 1, but alternative exemplary embodiments are not limited thereto.

The lower receiving member **110** receives the LCD panel **10** and the backlight unit **90** therein. In an exemplary embodiment, the lower receiving unit **110** is formed of a metal, for example, to protect the LCD panel **10** and backlight unit **90** from damage from external impact, for example.

The lower receiving member **110** may further include a connection aperture **111** to hold the mold frame **100** in the lower receiving member **110**. More specifically, a hook **105** (FIG. 5) protrudes from the mold frame **100** and is inserted through the connection aperture **111**. More specifically, connection apertures **111** of a plurality of connection apertures **111** are spaced from each other by a predetermined distance to coincide with locations of hooks **105** of a plurality of hooks **105**. Since an exemplary embodiment of the present invention utilizes the connection apertures **111** and the hooks **105**, other connection members such as bolts, for example, are not required. As a result a cost and a time required for assembling the components is substantially reduced.

The lower receiving member **110** may further include a notch **120** formed in a substantially rectilinear shape at a peripheral edge of the lower receiving member **110**, as shown in FIG. 1. A portion of the light source substrate **72** extends through the notch **120** to connect to an external device (not shown).

The LCD device may further include an attaching sheet **130** for fixing the LCD panel **10** to the backlight unit **90** and/or the optical sheet **80**, as shown in FIGS. 2A and 2B.

More specifically, a first side of the attaching sheet **130** is attached to a periphery of a lower surface (as viewed in FIGS. 1, 2A and 2B) of the LCD panel **10**, while a second side, opposite to the first side, of the attaching sheet **130** is attached to the optical sheet **80**, and even more specifically, to any one of the protective sheet **81**, the prism sheet **82** and/or diffusion sheet **83**, but alternative exemplary embodiments of the present invention are not limited thereto. For example, the attaching sheet **130** could be attached to the prism sheet **82** or the diffusion sheet **83**. The attaching sheet **130** may hold the LCD panel **10** to the protective sheet **81**, for example, to effectively prevent the LCD panel **10** from moving, e.g., sliding with an area created between the optical sheet **80** and the TFT substrate **11**.

In addition, the attaching sheet **130** may be attached to the light source **70**, as shown in FIGS. 2A and 2B, thereby preventing the light source **70** from moving.

FIG. 4 is a perspective view showing a mold frame of the LCD device according to the exemplary embodiment of the present invention shown in FIG. 1. FIG. 5 is an enlarged perspective view of area "A" of FIG. 4.

Referring to FIGS. 4 and 5, the mold frame **100** includes a side wall **101**, a panel supporter **102** and a light leakage prevention portion **106**.

The side wall **101** engages an inner wall of the lower receiving member **110** (FIG. 1). In an exemplary embodiment, the side wall **101** is thin compared to other side walls of

the mold frame **100**, or alternatively, the side wall **101** may be omitted. Further, the side wall **101** may have a constant thickness, or a thickness thereof may decrease, e.g., taper, as the side wall **101** extends away from the mold frame **100**.

The light source **70** is disposed proximate to the mold frame **100**.

The panel supporter **102** extends inward from the side wall **101** toward a central portion of the mold frame **100** to support the LCD panel **10** at an upper surface thereof (best shown in FIGS. 2A and 2B). More specifically, the panel supporter **102** may cover a peripheral portion of an upper surface of the TFT substrate **11** (FIG. 2A) or an upper surface of the color filter substrate **12** (FIG. 2B).

Referring to FIG. 4, the light leakage prevention portion **106** extends substantially from an end of a first supporter **102** an end of a second panel supporter **102** facing, e.g., disposed opposite to, the first panel supporter **102**. The light leakage prevention portion **106** covers an area wherein the light source **70** is disposed in the lower receiving member **110**, and prevents leakage of light from the light source **70** to outside the LCD device. In an alternative exemplary embodiment, the light leakage prevention portion **106** may be formed to cover and/or contact an upper side of the circuit board **40** (FIG. 1).

In addition, the light leakage prevention portion **106** may provide further, e.g., indirect, support for the LCD panel **10**.

In yet another exemplary embodiment of the present invention, the light leakage prevention portion **106** may also be formed to substantially overlap the driver **20** (FIG. 1). In addition, the light leakage prevention portion **106** may be formed to have a thinner thickness than a thickness of the panel supporter **102**, so that the circuit board **40** may be disposed under the light leakage prevention portion **106**.

Referring again to FIGS. 2A, 2B and 4, the mold frame **100** may further include an extending portion **103**. The extending portion **103** may extend outward from the side wall **101** of the mold frame **100**, e.g., away from the central portion of the mold frame **100**. The extending portion **103** is received by the lower receiving member **110** to protect the LCD panel **10**, optical sheet **80**, and light source **70** from damage from external impact, for example.

Referring to FIGS. 4 and 5, the side wall **101** may further include a plurality of fixing holes **104** through which the first protrusion **84a**, the second protrusion **84b** and the third protrusion **84c** pass.

The side wall **101** includes the plurality of hooks **105** which are inserted and locked in the connection apertures **111** of the lower receiving member **110**, as described above in greater detail. The hooks **105** may extend outward from the side wall **101**, as shown in FIGS. 4 and 5.

Thus, the LCD device according to exemplary embodiments of the present invention effectively prevents the LCD panel **10** from separating from other components of the LCD device, even though the LCD device does not include a top chassis, because the mold frame **100** covers and supports the LCD panel **10**, as described above in further detail with reference to FIGS. 1 to 5.

FIG. 6 is an exploded perspective view of an LCD device according to an alternative exemplary embodiment of the present invention. The same labels of FIG. 1 indicate the same or like components of FIG. 6, and any repetitive detailed description thereof has been omitted.

Referring to FIG. 6, the light source **70** of an LCD device according to an alternative exemplary embodiment is a fluorescent lamp **170**.

The fluorescent lamp **170** is a cold cathode fluorescent lamp ("CCFL") or, alternatively, a hot cathode fluorescent lamp ("HCFL"). Further, the fluorescent lamp **170** is disposed

near a peripheral portion of the light guide plate **50**, for example, as shown in FIG. **6**. A lamp cover (not shown) may be disposed to cover a portion of the fluorescent lamp **170**.

The CCFL may include a discharge tube, a fluorescent substance disposed in the discharge tube, a mixed gas injected in the discharge tube and lamp electrodes disposed near opposite ends of the discharge tube.

In operation of the CCFL, ultraviolet rays generated when negative ions collide with the mixed gas excite the fluorescent substance to radiate visible light.

In contrast, the HCFL generates a heating current in a filament electrode. The filament electrode is coated with a material which has a low work function, such as barium (Ba), for example, to facilitate emission of electrons, e.g., heat electrons. In the HCFL, the filament electrode is heated by applying the heating current, and the heat electrons are thereby emitted from the filament electrode. The heat electrons flow to a negative electrode and collide with a buffer gas, such as argon (Ar), and a main discharge gas, such as mercury gas (Hg), for example to radiate ultraviolet rays. The ultraviolet rays excite a fluorescent substance to emit visible light.

FIG. **7** is a flow chart illustrating steps of a method of assembling an LCD device according to an exemplary embodiment of the present invention, and FIGS. **8A** to **8E** are exploded perspective views illustrating sequential steps of assembling an LCD device using the method according to the exemplary embodiment of the present invention shown in FIG. **7**.

The method of assembling the LCD device includes placing the LCD panel **10** in the mold frame **100** (**S10**), placing the optical sheet **80** under the LCD panel **10** (**S20**), placing the light guide plate **50** under the optical sheet **80** (**S30**), placing the light source **70** near a side of the light guide plate **50** (**S40**) and combining the lower receiving member **110** with the mold frame **100** (**S50**), as will now be described in further detail with reference to FIGS. **7** to **8E**. The same reference numerals in FIGS. **1** to **5** represent the same or like components in FIGS. **7** to **8E**, and any repetitive description thereof will hereinafter be omitted. For purposes of description hereinafter, it will be noted that the LCD device shown in FIGS. **7** to **8E** has been inverted, e.g., is upside down, with respect to an orientation of the LCD device shown in FIGS. **1** to **5**.

In step **S10**, an upper surface of the LCD panel **10** is disposed on the panel supporter **102** of the mold frame **100** to be supported by the panel supporter **102**, as shown in FIG. **8A**. More specifically, an upper surface of the TFT substrate **11** (FIG. **2A**) or an upper surface of the color filter substrate **12** (FIG. **2B**) is supported by the panel supporter **102**.

In step **S20**, the optical sheet **80**, e.g., the protective sheet **81**, the prism sheet **82** and/or the diffusion sheet **83**, is disposed under the LCD panel **10**. More specifically and referring to FIG. **8B**, in an exemplary embodiment, the protective sheet **81** is disposed on, e.g., under, the LCD panel **10**, and the prism sheet **82** is then disposed on, e.g., under, the protective sheet **81**. The diffusion sheet **83** is then disposed on, e.g., under, the prism sheet **82**. Further, the optical sheet **80** is disposed proximate to the side wall **101** of the mold frame **100**, and the LCD panel **10** is thereby seated on the optical sheet **80**.

The step **S20** may further include disposing the attaching sheet **130** to a periphery of the optical sheet **80** or, alternatively, to a periphery of the LCD panel **10**. For example, a first surface of the attaching sheet **130** may be attached to the periphery of the LCD panel **10**, and a second surface, opposite the first surface, may be attached to the periphery of the optical sheet **80**. Alternatively, the first surface of the attaching sheet **130** may be attached to the periphery of the optical sheet **80**, and the second surface of the attaching sheet **130** may be attached to the periphery of the LCD panel **10**. In an exemplary embodiment, an adhesive material is applied to the

first surface and/or the second surface of the attaching sheet **130**. Thus, the attaching sheet is attached to the LCD panel **10** along each of four peripheral edges, e.g., the periphery, thereof.

The step **S20** may further include inserting the first protrusion **83a**, the second protrusion **84b** and the third protrusion **84c** into corresponding fixing holes **104**. The insertion of the first protrusion **83a**, the second protrusion **84b** and the third protrusion **84c** into the corresponding fixing holes **104** allows the optical sheet **80** to be locked, e.g., fixed, to the mold frame **100**.

In step **S30**, the light guide plate **50** is disposed on, e.g., under, the diffusion sheet **83** as shown in FIG. **8C**. An incident surface, e.g., a side of the light guide plate **50** which receives light, is aligned to be located proximate to an area of the mold frame **100** where the side wall **101** is not provided.

In step **S40**, the light source **70** is disposed proximate to the incident surface of the light guide plate **50** as shown in FIG. **8D**. As described in greater above with reference to FIGS. **1** to **5**, the LEDs **71** may be arranged to be spaced apart from the incident surface of the light guide plate **50** by a predetermined distance, thereby preventing deterioration of a display quality, such as by a bright line, for example. The light source substrate **72** of the light source **70** is disposed on the attaching sheet **130**, thereby attaching the light source substrate **72** to the attaching sheet **130** using the adhesive material applied to the first surface and/or the second surface of the attaching sheet **130**, as described above. Therefore, the light source substrate **72** is attached to the LCD panel **10** via the attaching sheet **130**. The step **S40** may further include disposing the reflective sheet **60** under the light guide plate **50**. In an exemplary embodiment, reflective sheet **60** is disposed to cover the LEDs **71**, as shown in FIG. **8D**.

In an alternative exemplary embodiment, the step **S30** may be performed after Step **S40**, e.g., the light guide plate **50** may be disposed under the diffusion sheet **83** after the light source **70** has been disposed proximate to the light guide plate **50**.

In step **S50**, the lower receiving member **110** is combined with the mold frame **100** in which the LCD panel **10**, the optical sheet **80**, the light guide plate **50**, the light source **70** and the reflective sheet **60** have been received. Specifically, the hooks **105** protruding from the mold frame **100** are inserted and locked into the connection apertures **111**, and the mold frame **100** is thereby effectively held to the lower receiving member **110**.

In an exemplary embodiment, the extending portion **103** is disposed on an upper surface of the lower receiving member **110**. Thus, damage to the LCD panel **10**, the backlight unit **90** and the panel supporter **102**, which occurs when the lower receiving member **110** is combined with the mold frame **100**, is effectively prevented. In an alternative exemplary embodiment, the extending portion **103** may be omitted.

According to exemplary embodiments of the present invention as described herein, an LCD panel is effectively prevented from coming off of a mold frame without use of a top chassis, resulting in an LCD device including the LCD panel having at least the advantages of being thinner and/or lighter.

The present invention should not be construed as being limited to the exemplary embodiments set forth herein. Rather, these exemplary embodiments are provided so that this disclosure will be thorough and complete and will fully convey the concept of the present invention to those skilled in the art.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit or scope of the present invention as defined in the following claims.

11

What is claimed is:

1. A display device comprising:
  - a display panel having an upper substrate and a bottom substrate and configured to display an image;
  - a mold frame configured to receive the display panel, the mold frame comprising:
    - a first side wall surrounding an open portion of the mold frame;
    - a display panel supporter extending from an upper portion of the first side wall toward the open portion of the mold frame; and
    - a protrusion extending from the first side wall away from the open portion of the mold frame; and
    - a lower receiving member having a second side wall configured to receive the mold frame and the display panel, the second side wall of the lower receiving member comprising a fixing aperture,
  - wherein an outer side surface of the first side wall of the mold frame faces an inner side surface of the second side wall of the lower receiving member,
  - the display panel supporter of the mold frame covers a peripheral portion of an upper surface of the display panel to support the display panel, and
  - the protrusion of the mold frame is inserted into the fixing aperture of the second side of the lower receiving member.
2. The display device of claim 1, wherein a thickness of the first side wall of the mold frame is one of a uniform thickness and a non-uniform thickness which decreases as the first side wall extends toward a bottom surface of the lower receiving container.
3. The display device of claim 1, further comprising a light source disposed between the mold frame and the lower receiving member, wherein the mold frame further comprises a light leakage prevention portion disposed above the light source on a portion of the peripheral area of the mold frame.
4. The display device of claim 1, wherein the mold frame further comprises an extending portion which extends from the upper portion of the first side wall in a direction opposite to an extending direction of the display panel supporter to cover an upper surface of the second side wall of the lower receiving member.
5. The display device of claim 1, further comprising a backlight unit disposed between the lower receiving unit and the display panel, the backlight unit comprising:
  - a light source configured to generate light; and
  - a light guide plate disposed on the light source to direct the light from the light source to the display panel.
6. The display device of claim 5, wherein the light source comprises one of a cold cathode fluorescent lamp and a hot cathode fluorescent lamp.
7. The display device of claim 6, wherein the backlight unit further comprises at least one optical sheet configured to receive the light generated by the light source, the optical sheet comprising at least one of a protective sheet, a prism sheet and a diffusion sheet.
8. The display device of claim 7, further comprising:
  - a reflective sheet disposed on the light guide plate to reflect the light to the light guide plate.
9. The display device of claim 8, further comprising:
  - an attaching sheet disposed between the display panel and the optical sheet to attach the display panel to the optical sheet.

12

10. The display device of claim 5, wherein the light source comprises:
  - a light source substrate; and
  - a light emitting diode disposed on the light source substrate.
11. The display device of claim 10, further comprising:
  - an attaching sheet disposed between the light source substrate and the display panel to attach the light source substrate to the display panel.
12. The display device of claim 5, further comprising:
  - a driver configured to drive the display panel; and
  - a circuit board disposed above the light source on a peripheral side of the display panel, wherein the circuit board transmits a driving signal to the driver.
13. The display device of claim 1, wherein the mold frame further comprises a hook extending from the first side wall away from the open portion of the mold frame, the second side wall of the lower receiving member comprises a connection aperture, and the hook of the mold frame is inserted into the connection aperture.
14. A method of assembling a display device comprising:
  - disposing a display panel in a mold frame, the mold frame comprising:
    - a first side wall surrounding an open portion of the mold frame;
    - a display panel supporter extending from an upper portion of the first side wall toward the open portion of the mold frame; and
    - an extending portion which extends outwardly from the first side wall away from the open portion of the mold frame to be disposed on an upper surface of a lower receiving member configured to receive the mold frame;
  - disposing an attaching member on a periphery of the display panel facing the lower receiving panel;
  - attaching the attaching member to the optical sheet;
  - disposing an optical sheet between the display panel and the light guide plate, the optical sheet comprising at least one of a protective sheet, a prism sheet and a diffusion sheet;
  - disposing a light guide plate on the display panel;
  - disposing a light source proximate to a side of the light guide plate; and
  - combining the mold frame with the lower receiving member,
  - wherein an outer surface of the first side wall of the mold frame faces an inner surface of a second side wall of the lower receiving member, and the display panel supporter of the mold frame covers a peripheral portion of an upper surface of the display panel to support the display panel.
15. The method of claim 14, wherein said disposing the optical sheet comprises inserting a protrusion disposed on the optical sheet into a corresponding fixing aperture disposed in the first side wall of the mold frame.
16. The method of claim 14, further comprising:
  - disposing an attaching member on a periphery of the display panel facing the lower receiving panel;
  - attaching the attaching member to the light guide plate; and
  - attaching the attaching member to the light source,
 after said disposing the display panel in the mold frame.
17. The method of claim 14, wherein said combining the mold frame with the lower receiving member comprises inserting a hook which protrudes from the first side wall of the mold frame into a connection aperture disposed in the lower receiving member.

\* \* \* \* \*